Unintended Consequences of a Ban on Illegal Fishing Gear

Evidence from a Field Experiment in Tanzania

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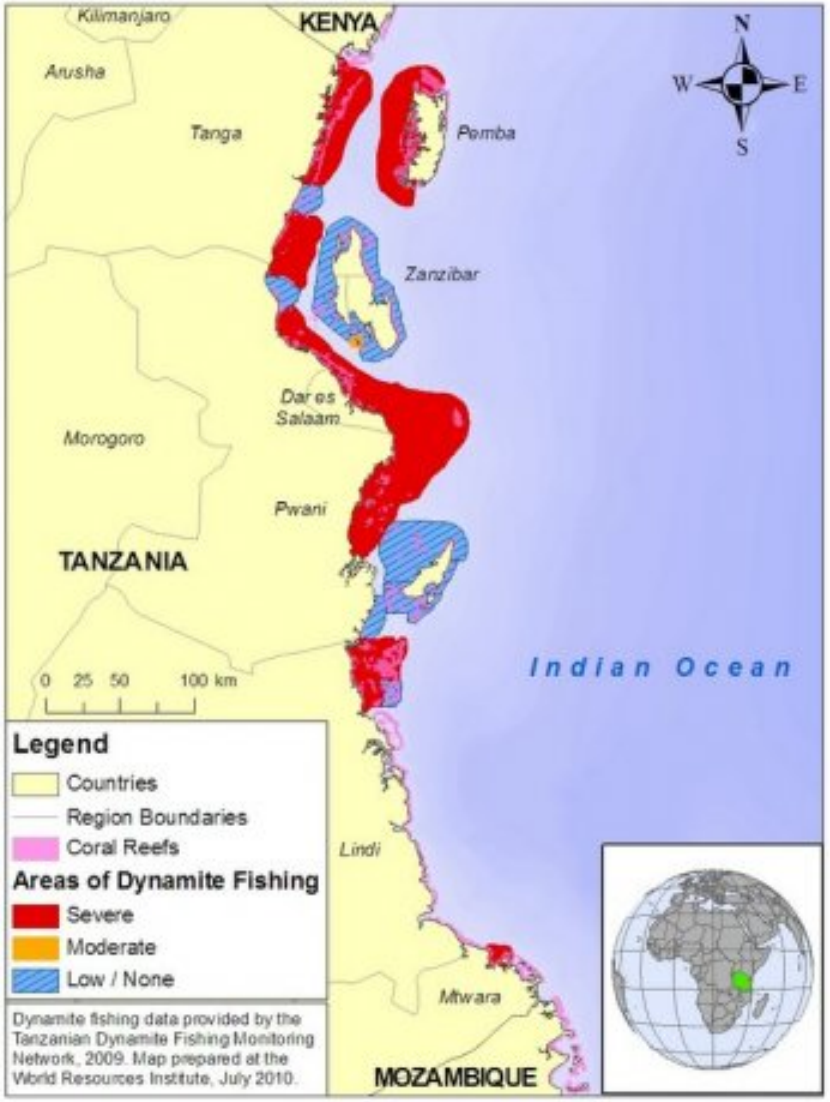
Motivation: Small-scale Fisheries

- Employ the majority of fishers worldwide
  - Approx. 90% of 38 million global fishermen (FAO, 2008)
- Majority in developing countries
  - Often lack the infrastructure and institutions of developed countries
  - Typically open access, unregulated, and/or regulations are poorly enforced
- How individuals act and interact is important for sustainable use of fish stock

Tanzania Small-scale Fisheries



- Tanzania fisheries are primarily small-scale and open access
- Illegal gear use (e.g. dynamite, small-mesh size) prevalent
- Overexploitation, poverty, and environmental destruction

Tanzania: Beach Management Units

- Beach Management Units (BMUs) introduced in 1998
  - Community management organization, tasked with sustainable management of fisheries
- BMUs have not performed as well as expected

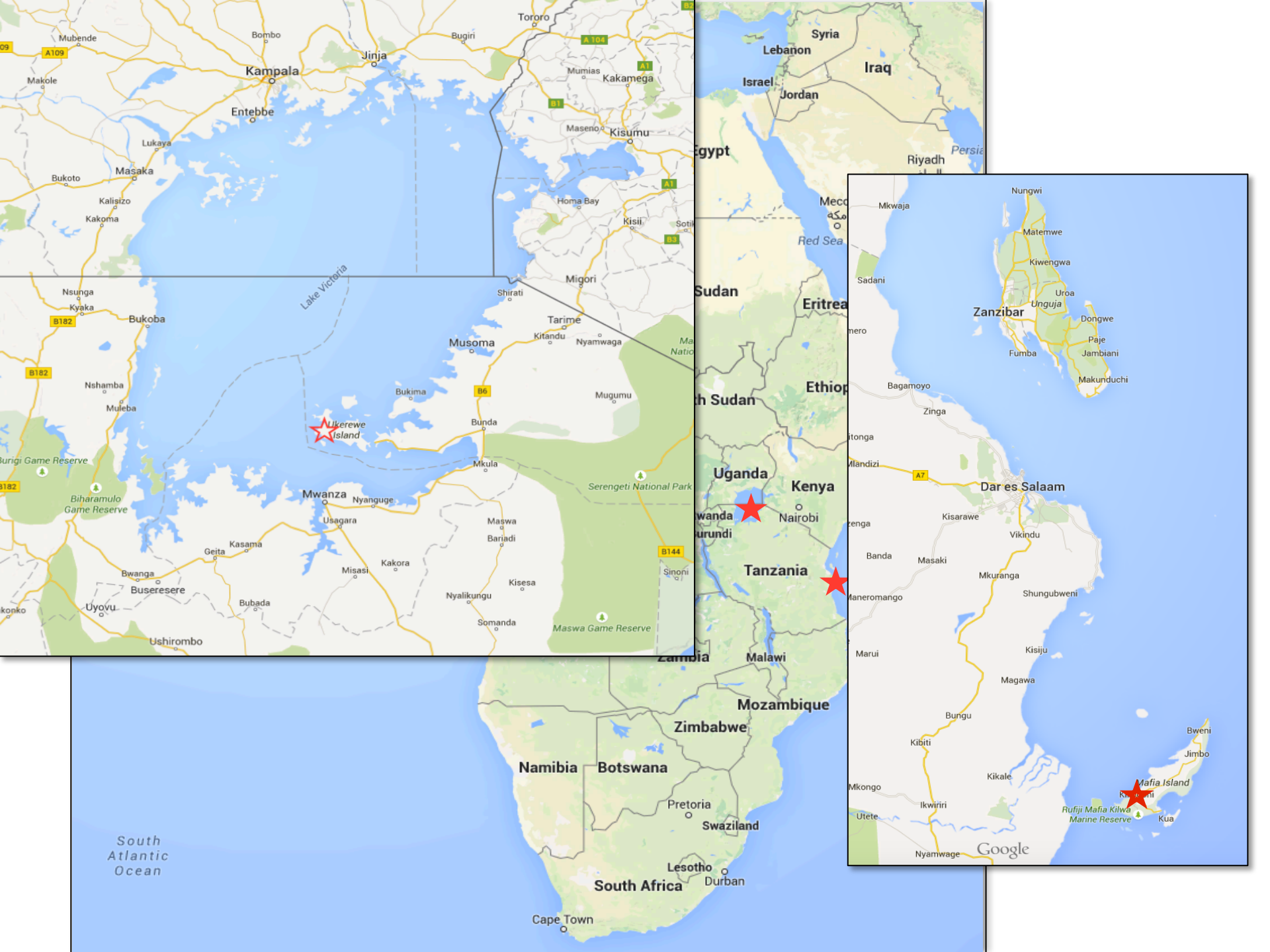
Focus Groups with BMUs

- Patrol and enforcement of illegal fishing practices sparse and ineffective
- Comment: BMU revenue (for patrols) and legal authority to enforce illegal ban would improve compliance and fishery performance

Research Question

What is the causal effect of enforcing an illegal gear ban on fishing behavior?

- Prediction: ability to enforce will increase cooperation and reduce exploitation rates
- Adds to enforcement/compliance literature
  - Expected effect not clear *a priori*
  - Local context: sample of local fishers in developing country context
  - Focus on both exploitation and compliance rates


Kampala
Entebbe
Jinja
Bombo
Mubende
Makole
Masaka
Bukoto
Kalisizo
Kakoma
Lukaya
Kisumu
Kakamega
Maseno
Homa Bay
Kisii
Migori
Shirati
Tarime
Kitandu
Nyamwaga
Musoma
Bukoba
Nsunga
Kyaka
Nshamba
Muleba
Bukima
Mugumu
Bunda
Ukerewe Island
Mkula
Mwanza
Nyanguge
Usagara
Maswa
Bariadi
Geita
Kasama
Misasi
Kakora
Sinoni
Kisesa
Nyalikungu
Somanda
Bubada
Bwanga
Buseresere
Uyovu
Ushirombo
Lake Victoria
Serengeti National Park
Maswa Game Reserve
Biharamulo Game Reserve
Burigi Game Reserve
Tororo
Bugiri
Syria
Lebanon
Israel
Jordan
Iraq
Egypt
Riyadh
Red Sea
Sudan
Eritrea
Ethiopia
South Sudan
Uganda
Kenya
Nairobi
Rwanda
Burundi
Tanzania
Zambia
Malawi
Mozambique
Zimbabwe
Namibia
Botswana
Pretoria
Swaziland
Lesotho
South Africa
Durban
Cape Town
South Atlantic Ocean
Nungwi
Mkwaja
Matemwe
Kiwengwa
Sadani
Uroa
Unguja
Zanzibar
Dongwe
Paje
Jambiani
Fumba
Makunduchi
Bagamoyo
Zinga
Dar es Salaam
Kisarawe
Vikindu
Banda
Masaki
Mkuranga
Shungubweni
Marui
Kisiju
Magawa
Bungu
Kibiti
Bweni
Jimbo
Kikale
Mafia Island
Mkongo
Ikwiriri
Utete
Rufiji Mafia Kilwa Marine Reserve
Kua
Nyamwage
Google

Game Design

Designed to capture key features of Tanzania small-scale fisheries

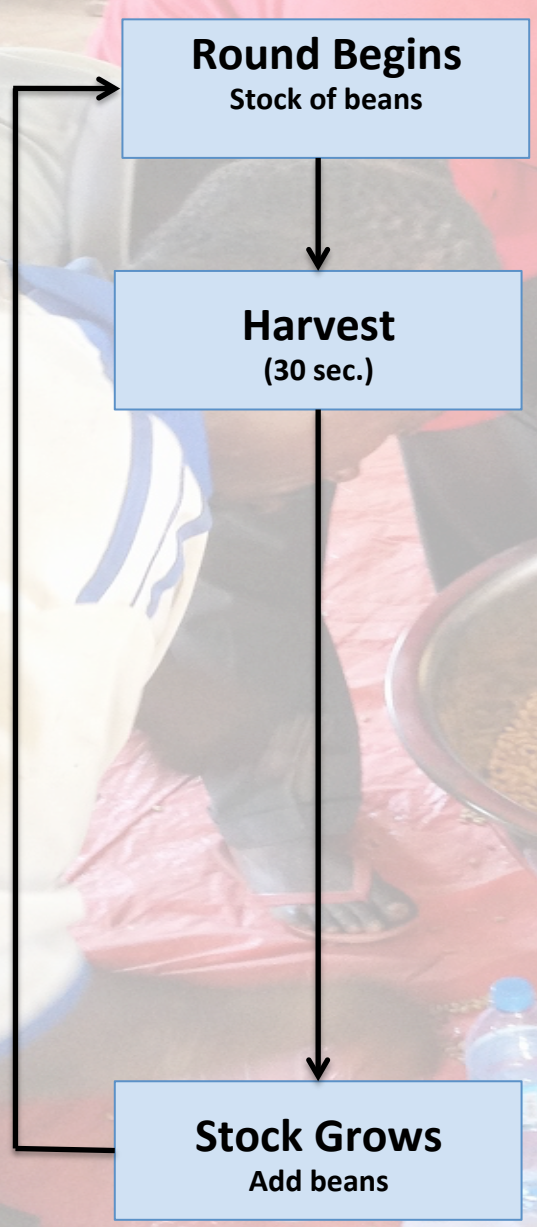
- Dynamic
- Interactive
- Interdependent
- Voluntary compliance

Designed to represent "real-life" fishing

- Players harvested beans from a communal bucket (Knapp and Murphy, 2010)
- Players paid for their harvest in TZ shillings at the end of each game


Harvest Only
Illegal Gear
Illegal Gear & Enforcement
Round Begins
Stock of beans
Choose Gear
Legal or illegal
Illegal = 2 x harvest
Harvest
(30 sec.)
Prob = 0.5
Patrol
Randomly select player
Reveal Gear
Legal or Illegal
Punish if Illegal
Remove Harvest
From illegal gear
Stock Grows
Add beans

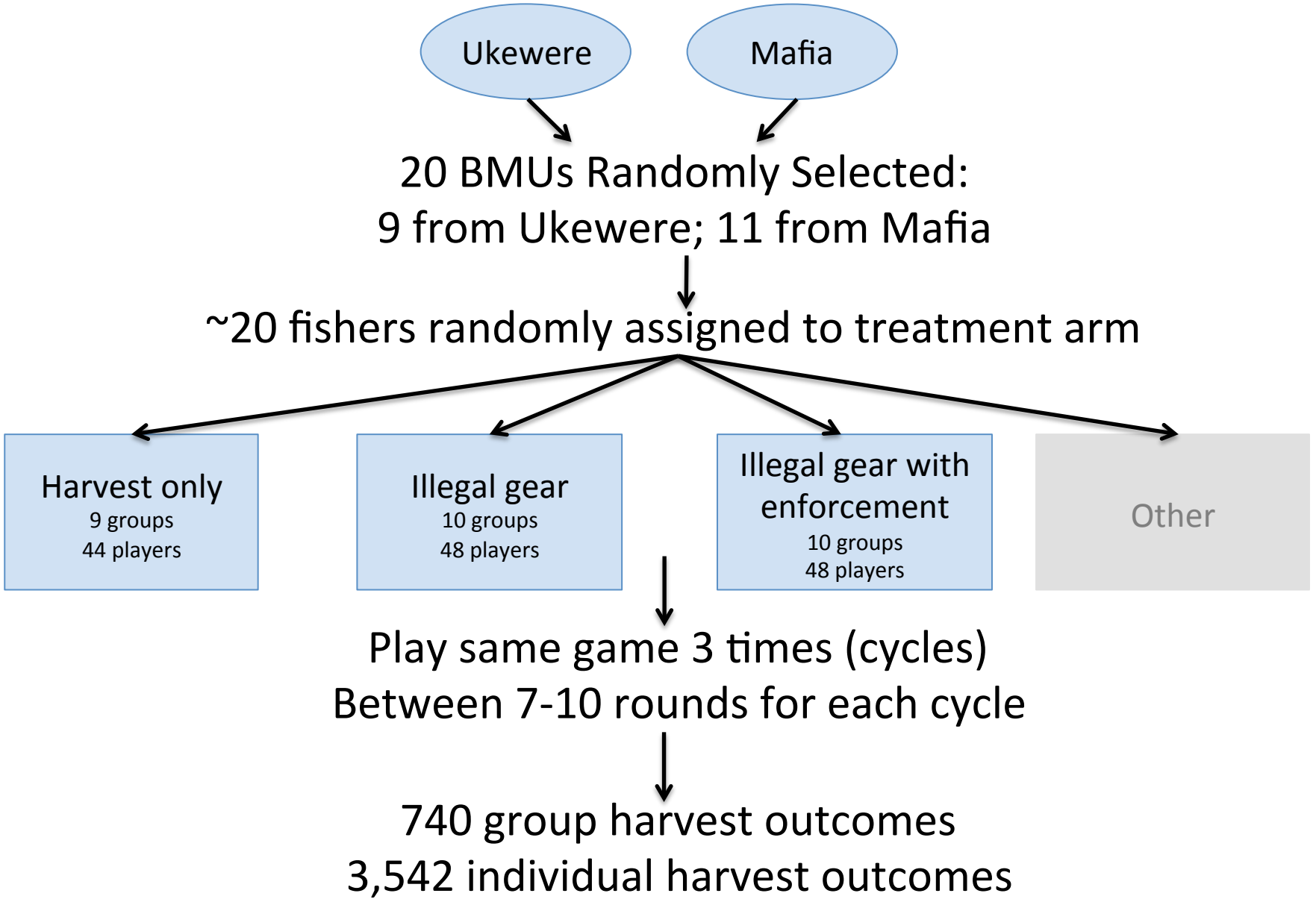
Harvest Only



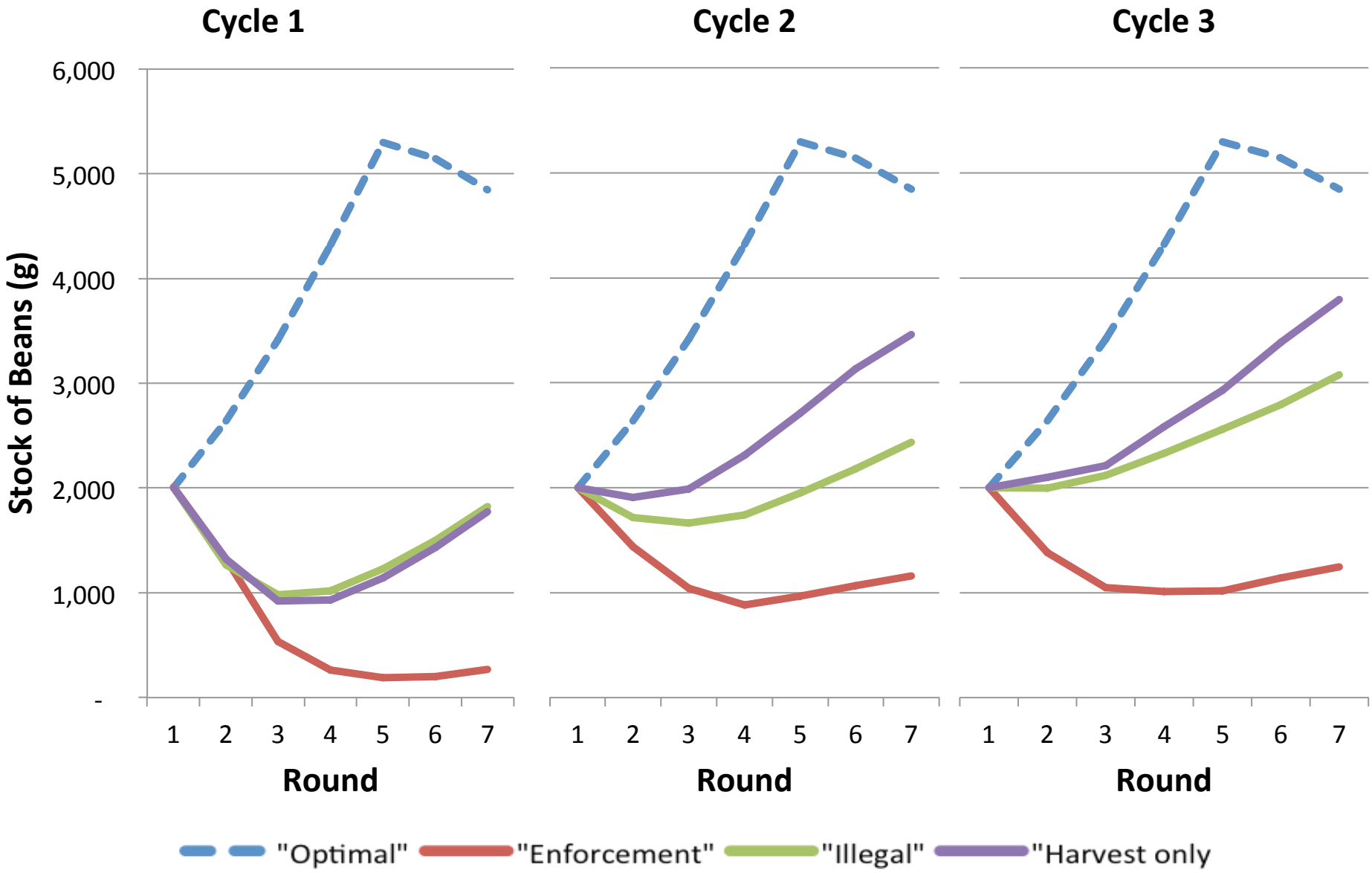
Details

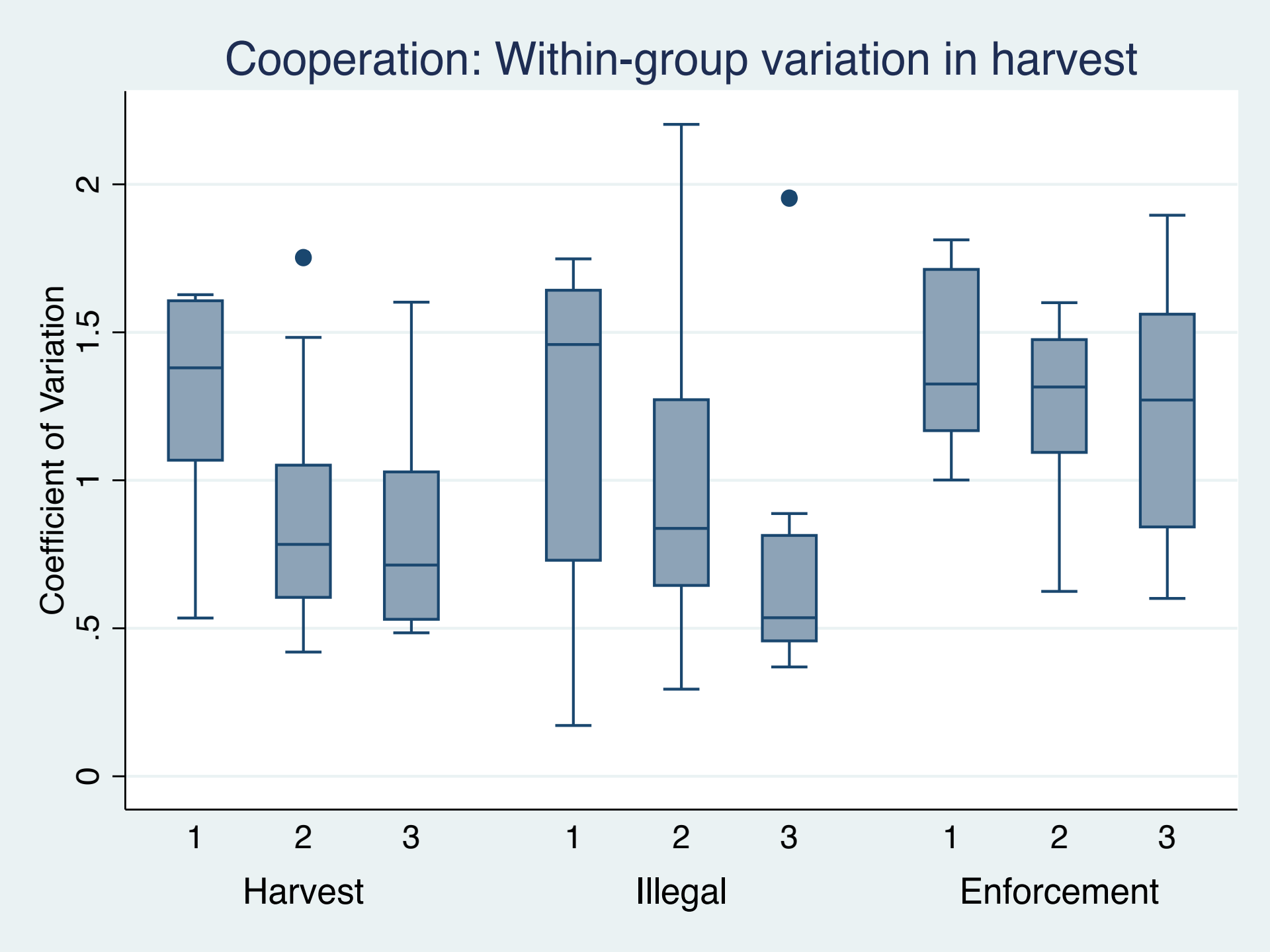
- Players told game lasts between 7 and 15 rounds
  - Avoid "terminal effect"
  - Actually ended between 7 and 10 rounds
- Logistic growth
  - Observed by players
- Practice Rounds

Experimental Design



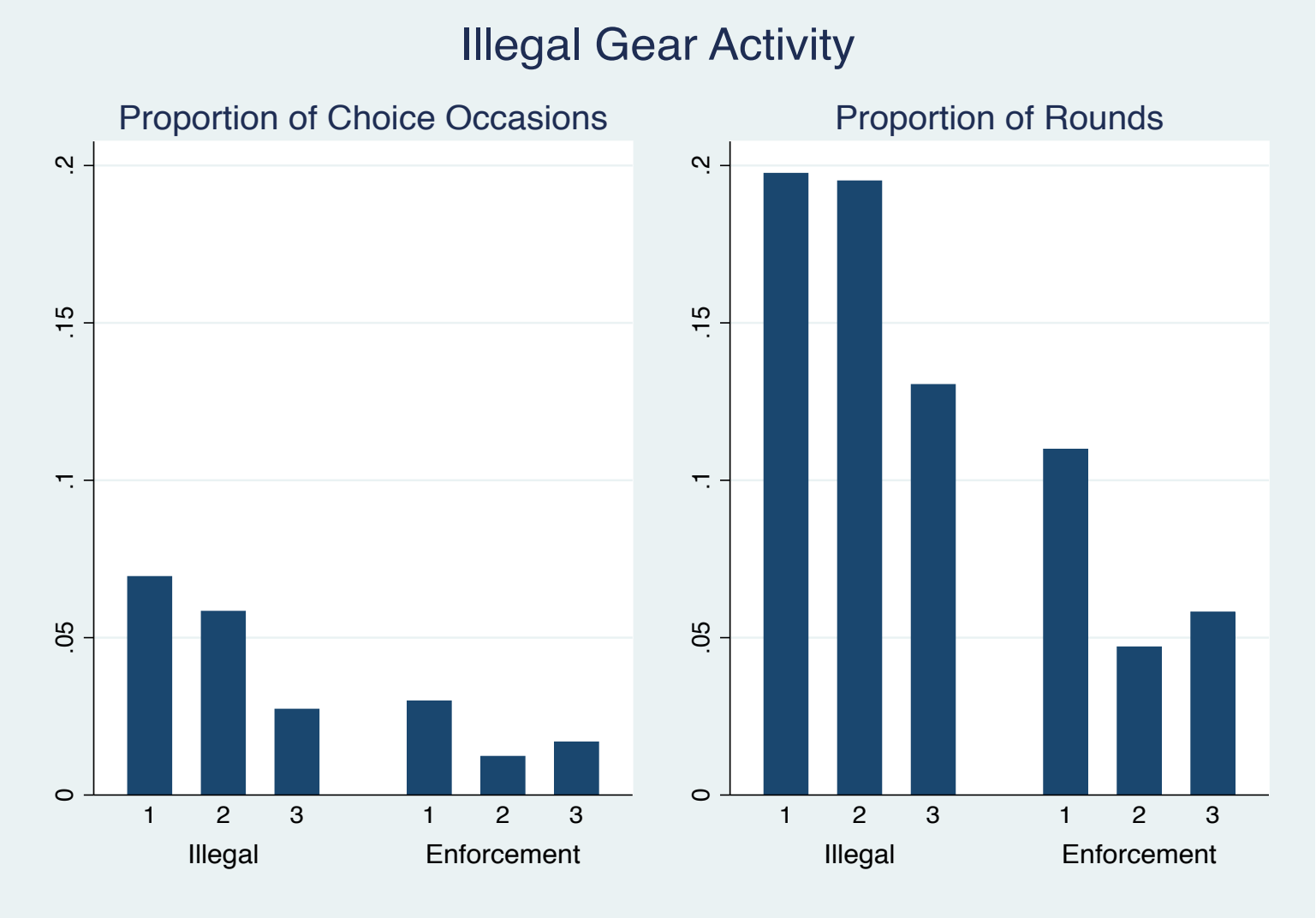
Evolution of Fish Stock (Average)




Cooperation: Within-group variation in harvest
Coefficient of Variation
0
.5
1
1.5
2
1
2
3
1
2
3
1
2
3
Harvest
Illegal
Enforcement

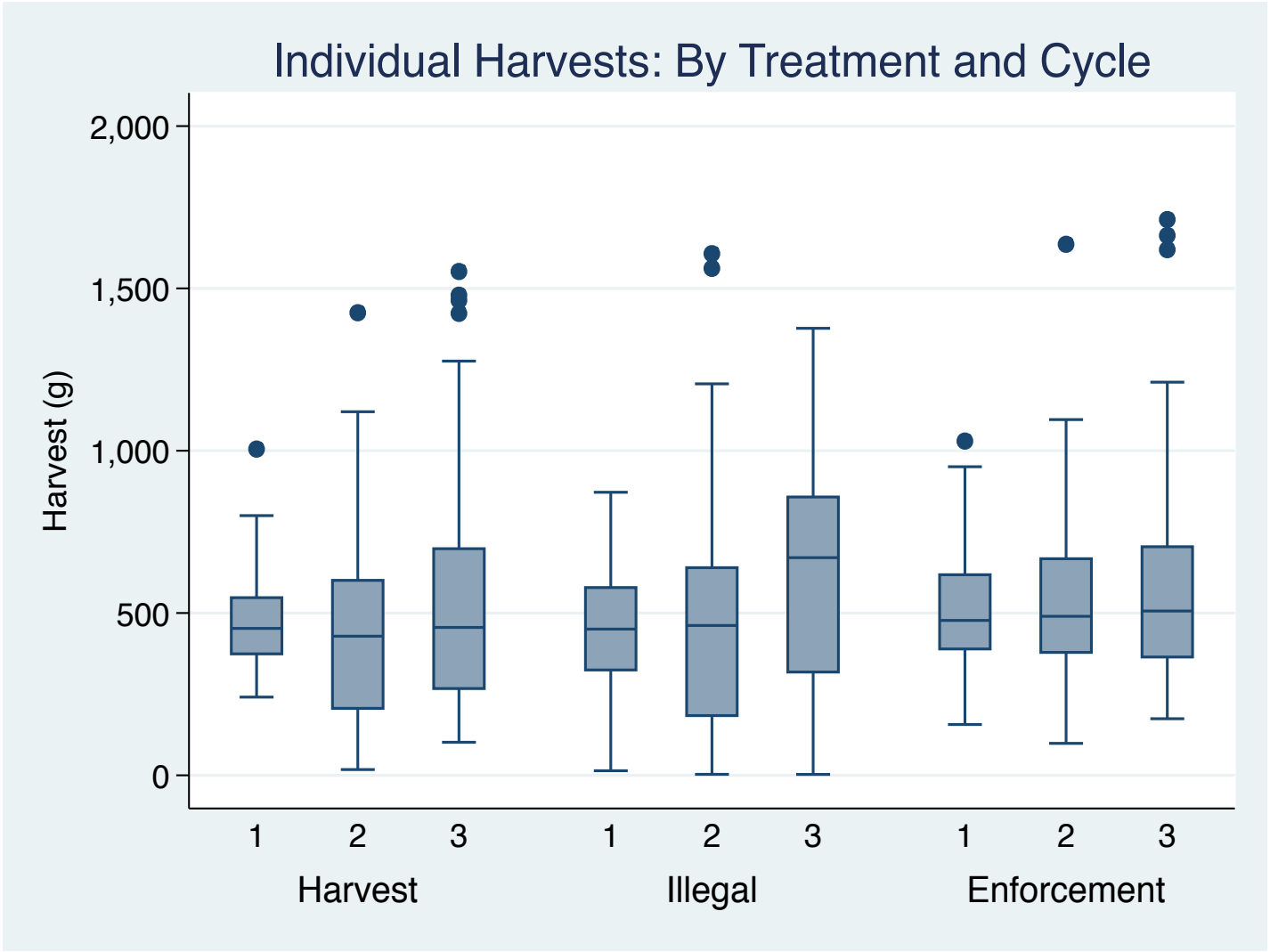
Explanation 1: Is a Fine a Price?

No. Very little illegal gear activity.



Explanation 2: Income Maximization?

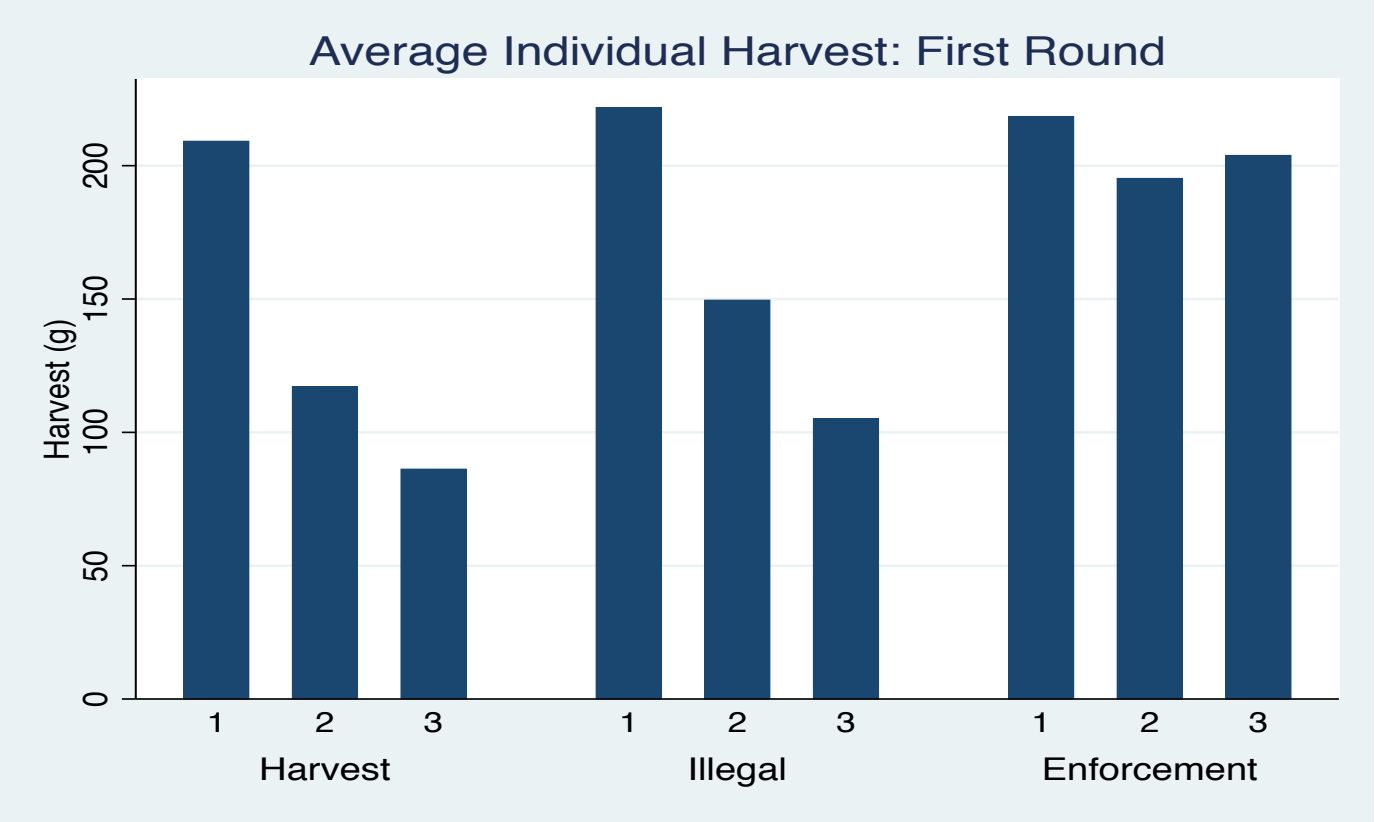
No major differences in harvest levels.



Explanation 3: Erroneous Patrol Signal?

Patrols that reveal "cooperative behavior" send an erroneous positive signal of performance

Testable prediction 1: First round harvest (prior to patrols) shouldn't differ across treatments



Explanation 3: Erroneous Patrol Signal?

Patrols that reveal "cooperative behavior" send an erroneous positive signal of performance

Testable prediction 2: Harvest rates should increase after a "positive" patrols.

No evidence of this.

Conclusions

Enforcement of a illegal gear ban results in:

1. Improved compliance (limited evidence)
2. Increased exploitation rates
3. Decreased cooperation

- Mechanism is not clear
  - Crowding out behavior?
  - Multiple potential explanations for results

Conclusions

External validity:

- Do experimental results inform potential effects of illegal gear enforcement in the real world?
- Or are the results simply an artifact of the game?

Conclusions

Bigger Picture:

- Analysis is a slice of a bigger project: what's the potential role of experiments for improving local management of small-scale fisheries?
- Can a structured experiential learning event improve local governance in the real world?
- Or more generally: Can experiments affect real-world behavior?

Acknowledgements

BASIS

FEED THE FUTURE BASIS ASSETS
AND MARKET ACCESS INNOVATION LAB